IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:	Bhashyam Ramesh	Group Art Unit:	2165
Serial No.:	10/068,214	Examiner:	Diane D. Mizrahi
Filed:	February 6, 2002		
For:	PARTITIONED JOINS OF SPATIAL OBJECTS IN A DATABASE SYSTEM	Atty. Dkt. No.:	10002 (NCR)

Mail Stop Appeal Brief
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

BRIEF IN SUPPORT OF APPEAL

This is a brief in support of Applicant's notice of appeal filed on November 7, 2005, in response to the final rejection dated July 7, 2005, in this matter.

Applicant is filing this brief along with any required fee.

CERTIFICATION OF MAILING UNDER 37 CFR 1.8

I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail in an envelope addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on 2/1/06.

By: Michelle George
Name: Michelle George

(1) REAL PARTY IN INTEREST

The real party in interest in this matter is NCR Corporation, Dayton, Ohio, by virtue of an assignment recorded at reel 012576, frame 0496-0500, on February 6 , 2002.

(2) RELATED APPEALS AND INTERFERENCES

Applicant is aware of no active appeals or interferences related to this application.

(3) STATUS OF CLAIMS

Claims 1-39 are currently pending. Claims 1-7, 9-10, 13-24, 29, 33-35, and 38 are subject to a final rejection and are under appeal. Claims 8, 11-12, 25-28, 30-32, 36-37, and 39 are allowable but have been objected to as being dependent upon a rejected base claim. The text of the claims, as currently pending, is attached as an appendix to this brief.

Dependent claims 13-21 and 23 are listed on the Office Action Summary as rejected but the Office has failed to provided specific grounds for their rejection. If the grounds for rejection differ from those used to reject the other claims, Applicant requests that prosecution be reopened.

(4) STATUS OF AMENDMENTS

On October 7, 2005, Applicant filed a reply to the final rejection dated July 7, 2005. This reply contained no new amendments. In an Advisory Action mailed on November 1, 2005, the Office rejected Applicant's rebuttal arguments and maintained all rejections.

(5) SUMMARY OF CLAIMED SUBJECT MATTER

Independent claim 1 recites a method for use in a computer implemented database system (e.g., page 3, paragraph 17 and 19; Fig. 1, element 10), comprising storing plural tables (e.g., page 4, paragraph 20; Fig. 1, elements 21) each containing spatial objects (e.g., page 5, paragraph 26); dividing the spatial objects across plural partitions (e.g., page 4, paragraph 21 and pages 10-11, paragraph 44; Figure 1, elements 18, 20, and 21);

and performing, in parallel in the plural partitions, a join of the spatial objects of the plural tables (e.g., pages 4 and 5, paragraph 23; Figure 1, element 10).

Independent claim 24 recites an article comprising at least one storage medium containing instructions that when executed cause a database system to (e.g., page 21, paragraphs 81-82): represent the spatial objects as z-cells in z-ordered space (e.g., page 5, paragraphs 24-25; Fig. 2); distribute the z-cells representing the spatial objects of tables across plural partitions; and perform a join of the distributed z-cells in each partition (e.g., page 4-5 paragraph 23; Fig. 1, elements 20-21).

Independent claim 33 recites a database system comprising: a storage subsystem to store tables containing spatial objects (e.g., page 4-5, paragraph 23; Fig. 1, elements 10, 20, and 21); a plurality of access modules to manage parallel access of respective portions of the storage subsystem (e.g., page 4, paragraphs 21-22; Fig. 1, element 18); and a controller adapted to manage a parallel join of the spatial objects by the plurality of access modules (e.g., pages 4-5 paragraph 23 and pages 20-21 paragraph 80; Fig. 1, element 10).

(6) GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

A. Claims 1 and 33 are rejected under 35 USC § 102(e) as being anticipated by Hopeman et al. (US Pat. No. 6,606,621).

B. Claim 24 is rejected under 35 USC § 102(e) as being anticipated by DeKimpe et al. (US Pat. No. 6,546,395).

(7) ARGUMENT

All rejected claims should be allowed over the cited references for the reasons set forth below.

A 35 USC § 102(e) rejection of claims 1 and 33 by Hopeman

Hopeman does not show or suggest "performing, in parallel in the plural partitions, a join of the spatial objects of the plural tables," as required by Applicant. The Office asserts that Hopeman's "multi-dimensional database" is equivalent to Applicant's

"plural tables," but the Office never provides an explanation as to why it holds this belief. Hopeman never uses the term "table," let alone the term "plural tables," nor are plural tables required by any of the teachings of Hopeman. Hopeman is also silent on the implementation of the multi-dimensional database. Furthermore, the mere presence of a multi-dimensional database does not imply the presence of plural tables since it is possible to implement a multi-dimensional database with a single table. In rejecting other claims in this application, the Office cites Dekimpe which teaches, "[t]he data for these dimensions [of a multi-dimensional database] and members may be stored in a table." (Col. 2, lines 46-47). The Office's own reference indicates that a single table is all that is needed to implement a multi-dimensional database. Therefore, Hopeman fails to explicitly or inherently teach plural tables. This element is missing from Hopeman. Additionally, the Office has failed to provide a proper explanation for this reference as required by 37 CFR § 1.104(c)(2) which states "the pertinence of each reference, if not apparent, must be clearly explained...."

Hopeman does not show or suggest spatial objects. In fact, the terms "object" or "objects" are not found within Hopeman. Neither is the term "spatial." The Office asserts that Hopeman's "dimensional cells" or "n-1 dimension cube" are equivalent to Applicant's "spatial objects." Applicant respectfully disagrees. A person of ordinary skill in the art would understand that database objects comprise one or more complex data types and that a spatial object would contain complex spatial data. The terms "dimensional cells" and "n-1 dimension cube" are terms used by Hopeman to describe the features and/or the organization of a multi-dimensional database, but they do not describe or constrain the data stored in the database. A dimensional cell is simple a location where data is stored. The data type is not defined. Similarly, each dimension of a multi-dimensional database is simply a characteristic or attribute used by the database to stored and retrieve data. For example, Hopeman uses the months of a year and names of cities as two dimensions. Neither of the these dimensions has any inherent requirement for spatial database objects, and Hopeman does not explicitly teach the use of any spatial database objects. Hopeman instead teaches the use of simple character strings which represent city names and months. A person of ordinary skill would not

equate a simple character string containing the name of month or city with a database object. Therefore, this element is missing from Hopeman.

Hopeman does not show or suggest "plural partitions," as required by Applicant. The Office asserts that Hopeman's "sub-cube" is equivalent to Applicant's "plural partitions." Applicant respectfully disagrees. Applicant requires the dividing of the spatial objects across plural partitions. Hopeman teaches "sub-cubing, wherein an n-dimensional cube is broken into a number of (n-1)-dimensional cubes and each of those cubes are processed ...." Dimensions of a multi-dimensional database are simply characteristics or attributes used to store and retrieve data in the database. Hopeman teaches a method of breaking a join operation into smaller operations using less than all the dimensions and then combining the results. This is called sub-cubing but it has nothing to do with dividing spatial object across plural partitions. Sub-cubing is independent of how or where data is stored. Additionally, the term "partition" is not used by Hopeman. Therefore, this element is also missing from Hopeman.

Finally, Hopeman does not show or suggest "performing, in parallel ... a join ...," as required by Applicant. Applicant is at a loss to understand the grounds used by the Office to reject this part of the claim. The Office cites col. 5, lines 64-66, which state that "[p]rocessing the hierarchies in different orders will yield different join hierarchies, reflecting the fact that it is possible to derive the aggregate cells in different ways." Hopeman makes no reference to parallel execution of a join or to the parallel execution of any function. This element is also missing from Hopeman.

Hopeman does not show or suggest at least the elements described above. Therefore, this rejection is improper and these claims and their dependent claims are allowable over this reference.

B 35 USC § 102(e) rejection of claim 24 by DeKimpe

DeKemple does not show or suggest "spatial objects as z-cells in z-ordered space," as required by Applicant. The Office has stated that figure 3 of DeKemple does depict "spatial objects as z-cells in z-ordered space." Applicant respectfully disagrees. DeKemple describes figure 3 as "a diagram that illustrates the logical structure of a multi-

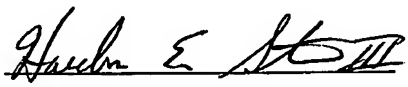
dimensional database ...." The logical structure of a multi-dimensional database is not modeled after and is not the same as z-cells in z-ordered space. Furthermore, there is no teaching within DeKemple that would lead a person of ordinary skill to believe otherwise. The terms *z-cell* or *z-ordered* do not appear within the text of DeKemple. Furthermore, the concepts of z-cells and z-ordered space are likewise missing from DeKemple. Therefore, DeKemple fails to teach all the elements of Applicant's claimed invention. The Office's rejection is improper and Applicant's claims are allowable over this reference.

C. Conclusion

None of the references cited show or suggest all of the features of Applicant's claims. Applicant therefore asks the Board to reverse the examiner's rejections and to allow all of the claims.

Please apply any charges or credits that might be due, except the issue fee, to the NCR Corporation deposit account number 14-0225.

Respectfully submitted,



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APPENDIX A - Current Listing of Amended Claims

Claim 1 (previously amended): A method for use in a computer implemented database system, comprising:

storing plural tables each containing spatial objects;

dividing the spatial objects across plural partitions; and

performing, in parallel in the plural partitions, a join of the spatial objects of the plural tables.

Claim 2 (original): The method of claim 1, further comprising decomposing each of the spatial objects into subspaces, the subspaces distributed across the plural partitions.

Claim 3 (original): The method of claim 2, wherein decomposing each of the spatial objects into subspaces comprises decomposing each of the spatial objects into z-cells according to z-ordering.

Claim 4 (original): The method of claim 3, wherein storing the plural tables containing spatial objects comprises storing the sets of z-cells, each set representing a spatial object.

Claim 5 (original): The method of claim 4, wherein storing the sets of z-cells comprises storing the sets at plural z-levels.

Claim 6 (original): The method of claim 5, further comprising identifying at least one of the plural levels as an optimal partition level at which partitioning of the spatial objects occurs.

Claim 7 (original): The method of claim 6, wherein identifying the optimal partition level is based on a cost-based analysis.

Claim 8 (original): The method of claim 7, further comprising performing the cost-based analysis by accumulating a count of a number of z-cells at each level.

Claim 9 (original): The method of claim 5, further comprising identifying at least one of the plural z-levels as an optimal join level at which a join of spatial objects of plural tables occurs.

Claim 10 (original): The method of claim 9, further comprising using a cost-based analysis to identify the optimal join level.

Claim 11 (original): The method of claim 9, further comprising determining, based on the z-level a given z-cell of a spatial object is at, whether to duplicate the given z-cell or to enumerate the given z-cell into z-cells at a lower level.

Claim 12 (original): The method of claim 11, further comprising duplicating the given z-cell to the plural partitions if the z-level of the given z-cell is at least a predetermined number of z-levels above the optimal join level.

Claim 13 (original): The method of claim 12, further comprising enumerating the given z-cell if the z-level of the given z-cell is less than the predetermined number of levels above the optimal join level.

Claim 14 (original): The method of claim 13, wherein enumerating the given z-cell comprises dividing the given z-cell, if the z-level is greater than the optimal join level, the given z-cell into corresponding z-cells at the optimal join level, the method further comprising redistributing the z-cells at the optimal join level.

Claim 15 (original): The method of claim 14, further comprising determining, if the z-level of the given z-cell is less than the optimal join level, the ancestor z-cell at the optimal join level containing the given z-cell, the method further comprising redistributing the z-cell at the optimal join level.

Claim 16 (original): The method of claim 15, wherein performing the join of the spatial objects comprises performing joins of z-cells based on comparisons of intervals of z-cells at the optimal join level representing the spatial objects on each partition.

Claim 17 (original): The method of claim 16, further comprising performing false hit avoidance to avoid false hits due to comparisons performed at the optimal join level.

Claim 18 (original): The method of claim 16, further comprising performing duplicate avoidance.

Claim19 (original): The method of claim 16, further comprising defining a z-cell less than the predetermined number of levels above the optimal join level, at the optimal join level, or below the optimal join level as having a zero-length interval,

the method further comprising optimizing the join for zero-length interval z-cells.

Claim 20 (original): The method of claim 16, further comprising defining a z-cell at least at the predetermined number of levels above the optimal join level as having a non-zero-length interval containing z-cells at the optimal join level.

Claim 21 (original): The method of claim 1, further comprising reducing skew in dividing the spatial objects across multiple partitions, and reducing duplication of objects to the multiple partitions to enhance efficient parallel spatial join.

Claim 22 (original): The method of claim 1, wherein dividing the spatial objects across plural partitions is based on characteristics of the spatial objects instead of characteristics of the tables.

Claim 23 (original): The method of claim 22, further comprising identifying an optimal partition level,

wherein dividing the spatial objects comprises performing one of duplication, enumeration, and redistribution based on a relationship of a spatial object to the optimal partition level.

Claim 24 (previously amended) An article comprising at least one computer-readable storage medium containing instructions that when executed cause a database system to:

represent the spatial objects as z-cells in z-ordered space;

distribute the z-cells representing the spatial objects of tables across plural partitions; and

perform a join of the distributed z-cells in each partition.

Claim 25 (original): The article of claim 24, wherein the spatial objects are represented by z-cells at plural z-levels, wherein the instructions when executed cause the database system to further define one of the z-levels as an optimal join level,

wherein performing the join is performed using z-cells at the optimal join level.

Claim 26 (original): The article of claim 25, wherein the instructions when executed cause the database system to further:

identify whether a given z-cell is at least a predetermined number of z-levels above the optimal join level; and

duplicate the given z-cell to the plural partitions if the given z-cell is at least the predetermined number of z-levels above the optimal join level.

Claim 27 (original): The article of claim 26, wherein the instructions when executed cause the database system to further:

enumerate the given z-cell into z-cells at the optimal join level if the given z-cell is less than the predetermined number of z-levels above the optimal join level; and

distribute the z-cells at the optimal join level across the plural partitions.

Claim 28 (original): The article of claim 27, wherein the instructions when executed cause the database system to further:

identify an ancestor z-cell at the optimal join level containing the given z-cell if the given z-cell is at a z-level less than the optimal join level.

Claim 29 (original): The article of claim 24, wherein the instructions when executed cause the database system to further identify one of the z-levels as an optimal join level and one of the z-levels as an optimal partition level,

wherein performing the join is performed at the optimal join level, and

wherein distributing the z-cells representing the spatial objects is based on a relationship of each spatial object to the optimal partition level.

Claim 30 (original): The article of claim 29, wherein the instructions when executed cause the database system to identify the optimal join level and the optimal partition level based on a cost analysis.

Claim 31 (original): The article of claim 24, wherein the instructions when executed cause the database system to further perform false hit avoidance and duplicate avoidance.

Claim 32 (original): The article of claim 31, wherein the instructions when executed cause the database system to further:

define certain of the z-cells as having a zero-length interval; and

optimize the join for zero-length interval z-cells.

Claim 33 (previously amended): A computer implemented database system comprising:

a storage subsystem to store tables containing spatial objects;

a plurality of access modules to manage parallel access of respective portions of the storage subsystem; and

a controller adapted to manage a parallel join of the spatial objects by the plurality of access modules.

Claim 34 (original): The database system of claim 33, wherein the controller is adapted to represent the spatial objects in z-cells in a z-ordered space.

Claim 35 (original): The database system of claim 34, wherein the controller is adapted to manage the parallel join of the z-cells representing the spatial objects.

Claim 36 (original): The database system of claim 35, wherein the z-cells representing the spatial objects are in plural z-levels, the controller being adapted to identify one of the plural z-levels as an optimal join level,

the controller adapted to perform the parallel join of the z-cells at the optimal join level.

Claim 37 (original): The database system of claim 36, wherein the controller is adapted to:

identify one of the z-levels as an optimal partition level; and

distribute each spatial object across the plural access modules according to a relationship of the spatial object to the optimal partition level.

Claim 38 (original): The database system of claim 35, wherein the controller is adapted to distribute z-cells of the spatial objects across the access modules.

Claim 39 (original): The database system of claim 38, wherein the controller is adapted to distribute the z-cells by performing one of duplication, enumeration, and redistribution of each spatial object.

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NCR Docket No. 10002

Application of:

BHASHYAM, R. Group Art Unit: 2165

Serial No. 10/068,214 Examiner: Diane Mizrahi

Filed: February 6, 2002

For: PARTITIONED JOINS OF SPATIAL OBJECTS IN A DATABASE SYSTEM

Commissioner for Patents
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Alexandria, VA 22313-1450

APPEAL BRIEF TRANSMITTAL LETTER

Sir:

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Respectfully submitted,

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By: Michelle Hoyle
Name: Michelle Hoyle